Group 1: Charge Questions

1a. What are the most significant or important science questions that should drive ASP research in the next 5-10 years?

1b. What specific knowledge gaps must be filled?

2. What approaches are required by ASP science in the next five years to make the needed scientific advances?

Very broad questions

Large group

75 minutes

insufficiently prepared chair

1a. What are the most significant or important science questions that should drive ASP research in the next 5-10 years?

- At highest level:

  Current questions remain appropriate for ASP and wider community

  - What is the impact of aerosols on climate?
    - the indirect effects of aerosols on clouds
    - the role of black carbon and organic aerosols on climate
    - Other aerosols (esp. dust)

  - Quantification needed for:
    - Aerosol Life Cycle
    - Aerosol Direct Effects
    - Cloud-Aerosol Interactions

- At work-bench/station level:
  - Multitude of important research topics

- *Full list not practical here, needs groupings by science topic, approach, etc.*

1b. What specific knowledge gaps must be filled?

- ➢ Mid-level – some being done, but don't let fall between cracks
- Some general issues:

- Interactions between anthropogenic and biogenic emissions
  - E.g. effect of NOx on biogenic aerosols

- Need to get beyond simplistic classes, recognize diversity:
  - Black carbon is made of many things. Which parts are important for ccn, absorption, etc. ?
  - SOA comes in may flavors (biogenics, biomass burning, aromatic, polymerized, aliphatic) – some may be absorbing
  - Dust is many things (anthro and natural), good and bad CCN and IN

Aerosol Life Cycle

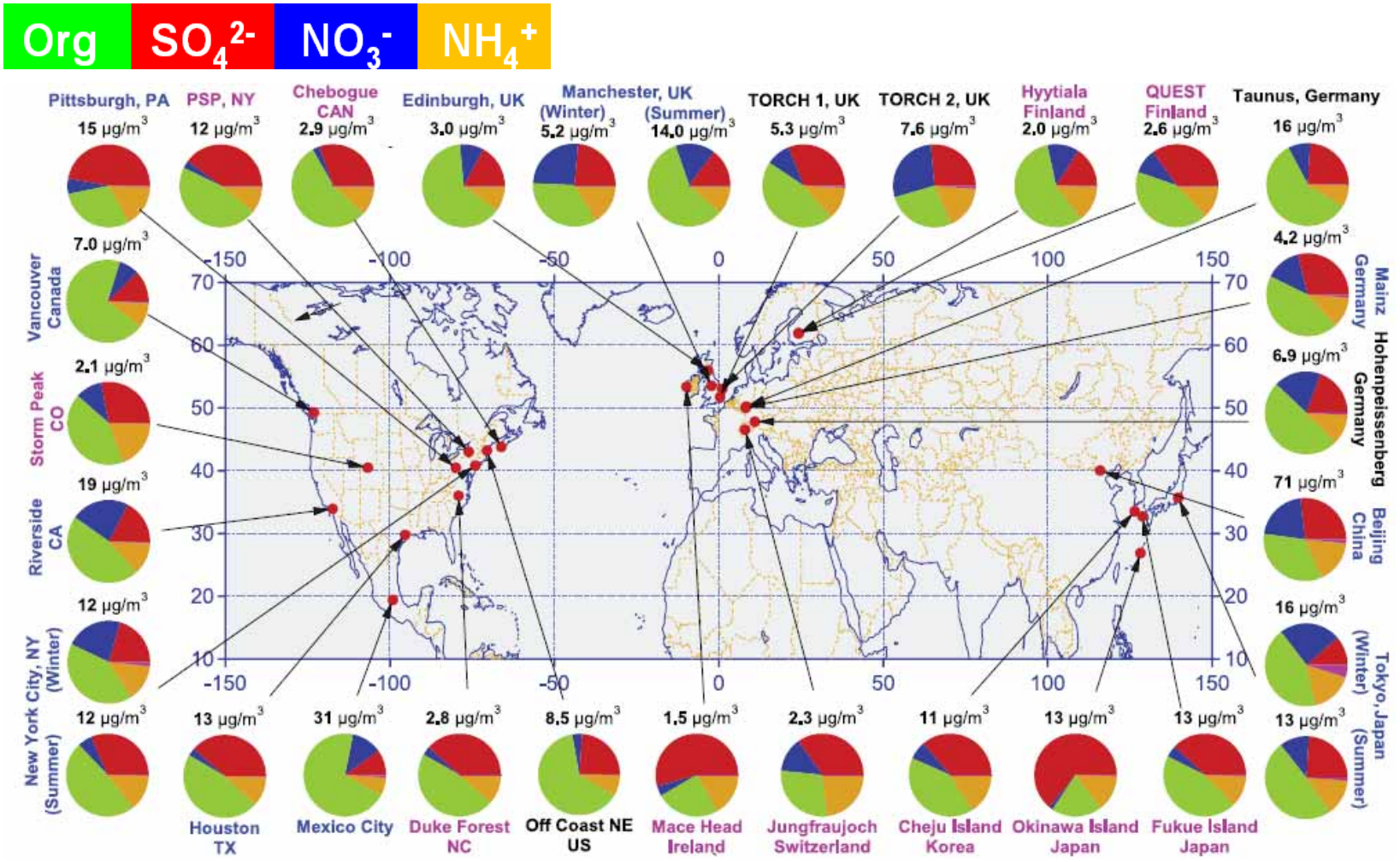
- Emissions of aerosol are uncertain and need to be improved (but are known better than other parts of life cycle)
  - Ambiguities: Primary vs. secondary; biomass burning gases & volatile aerosols
- Transformations (chemistry, volatility, mixing state) – strong coupling to gas phase
    - Sulfate fairly good shape
    - Nitrate poor
      - As you reduce sulfate, nitrate will be come relatively more important
    - SOA very poor
    - BC poor
  - Transport, esp. lofting, convective parameterizations, impact on cirrus
  - Removal known the least, strongly coupled to cloud-aerosol interactions
  - Other dynamic feedbacks, e.g. heating stabilization

Direct Radiative Impacts of Aerosols

- Considerable discussion on soot optics, depending on type of soot, evolution of morphology, oxidation, mixing state, coatings…

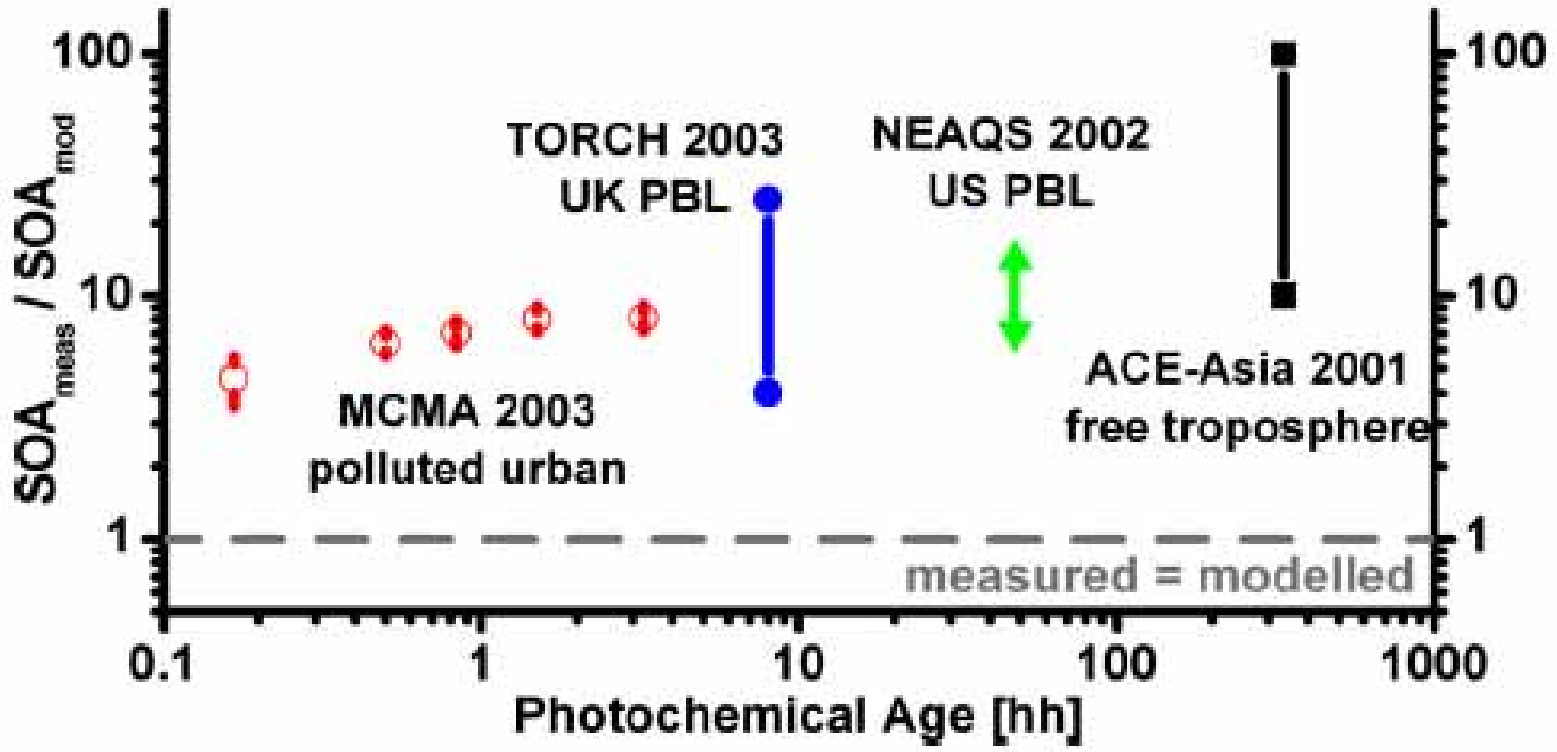
- SOA optical properties and radiative impacts not well known.
  - Absorption?
  - Estimate of direct forcing from observed SOA? Compare to sulfate

Organic aerosol > Sulfate in most observations



Zhang et al., GRL 2007

Models Under-predict SOA



Volkamer et al., GRL 2006

2. What approaches are required by ASP science in the next five years to make the needed scientific advances?

- Concurrence that need lab studies, field campaigns, large-scale/long-time observations, theory, models, instrument development. Need better interaction between these components

- Noted that models are sometimes a step beyond actual knowledge, building parameterizations where fundamental factors are not known, e.g.

  black carbon on sea ice
  effect of spatial resolution on SOA formation

- Field campaigns are critical for improving regional models (high resolution e.g. 3km, weather-scale chemistry, microphysics, radiation) before transferring parameterizations to GCMs.
  - *e.g. aerosol testbed*
  - *full measurement suite (chemistry, radiation, microphys)*
  - *regional climate*